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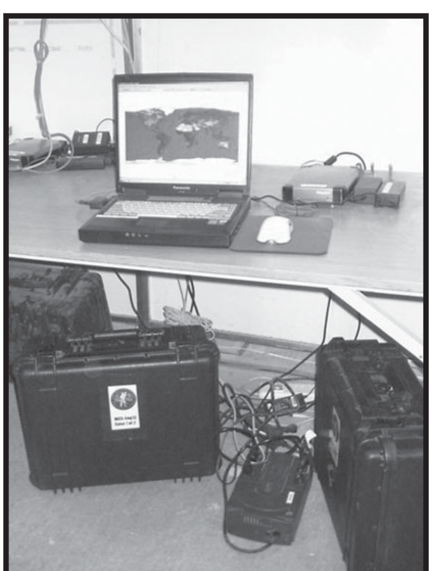
TOOLS OF WAR

By Captain Trey Birdwell and Captain John A. Klemunes, Jr.

Successful future operations depend on lessons learned from previous operations. This implies incremental improvements and review of each process. Tracking explosive hazards during Operation Iraqi Freedom is an example of improving operations by using lessons learned from Operation Desert Storm and the stability missions in Bosnia and Kosovo. Minefields and unexploded ordnance (UXO) are battlefield hazards that remain long after combat operations have ceased. Tracking explosive hazards continuously throughout operations over an area the size of California is extremely important. Equally significant is the establishment of a system to disseminate this information to subordinate commands daily. The system used by the Coalition Forces Land Component Command (CFLCC) engineer staff section (C7) was the Tactical Minefield Database (TMFDB) System prototype, which gave engineers a way to track and disseminate explosive hazards information on the battlefield. Using the TMFDB, the CFLCC tracked the location of all air and ground cluster munitions, as well as new and previously recorded minefields. (Note: The CFLCC emplaced no minefields during Operation Iraqi Freedom.)

Hazard Analysis of Main and Alternate Supply Routes



Tactical Minefield Database System

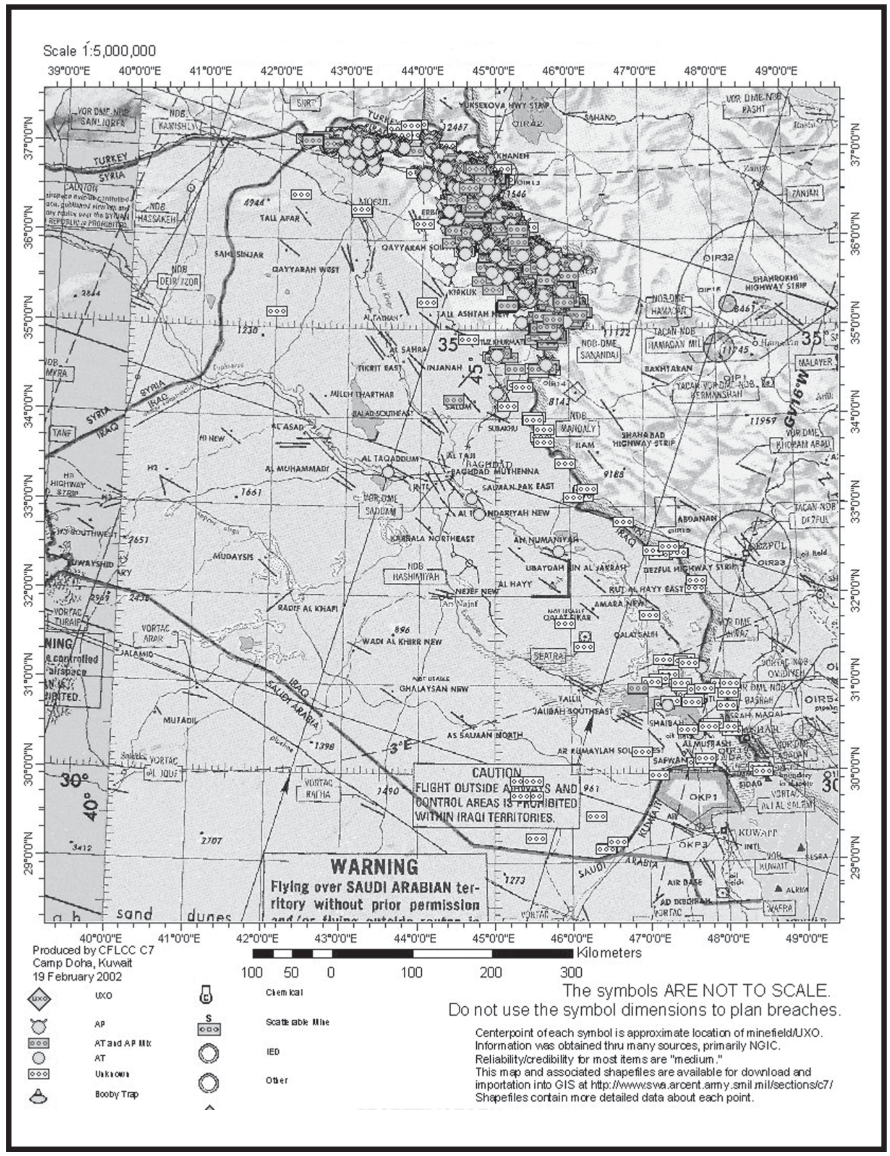
Before the TMFDB, Army engineers did not have an efficient, standard, automated method for recording, archiving, and disseminating enemy and friendly obstacles. During Operation Enduring Freedom in Afghanistan, Army engineers used Microsoft®Excel spreadsheets and grease pencils to track minefields and explosive hazards. This technique has not changed in the past 50 years and is used throughout the engineer community. Although this tracking technique archives valuable mine information, it does nothing more than simply save the information. What

we have not done in the past is make this information available in a common digital format for viewing, nor have we placed it in a database format that is conducive to analysis.

Placing minefield information in a digital format known as the common operational picture (COP) and entering the information in a database for analysis were the objectives of collection during Operation Iraqi Freedom. A system had to be found that could share the information via the COP and put it in a database format. The search started with current systems used by the CFLCC, including the Command and Control Personal Computer (C2PC) and the Force XXI Battlefield Command-Brigade and Below (FBCB2) System. While these systems are appropriate for command and control functions, they cannot process and manipulate obstacle information as part of a functional database to the required level of detail. After studying the systems used by the CFLCC and not finding an appropriate program, the U.S. Army Maneuver Support Center (MANSCEN), Fort Leonard Wood, Missouri, was asked to help in the search.

MANSCEN then asked the project director of Combat Terrain Information Systems (CTIS) to develop and distribute the TMFDB. MANSCEN, CTIS, and TASC (a business unit of Northrop Grumman Information Technology [IT]), have developed a portable system that combines mapping and imagery with a minefield-obstacle database as a subset of the Maneuver Control System-Engineer (MCS-E). During Operation Iraqi Freedom, CFLCC C7 purchased multiple TMFDB Systems and provided additional computers to the Coalition Joint Task Force-7 (CJTF-7) for posthostilities explosive hazards tracking.

The fielding requirement called for the theater engineer cell to employ the TMFDB to develop the hazard database foundation for the Mine and Explosive Ordnance Information Coordination Center (MEOICC) and to provide immediate explosive hazard situational awareness to all forces. The TMFDB enabled the CFLCC C7 to accomplish this task and distribute hazard information to nongovernmental and humanitarian assistance organizations. Three days after the war began, the CFLCC C7 distributed to these agencies information about all known hazards in the database, including all known minefields and mine strike information, dual-purpose improved conventional munitions (DPICMs), and cluster bomb unit (CBU) munitions.



Known or Suspected Minefield Locations

All the available data was placed in the database to establish a baseline, and daily data collection commenced. The CFLCC fire support element provided the impact grids and times for Army Tactical Missile System missions. Then the CFLCC had to locate munitions dropped by fixed-wing aircraft. This was slightly more difficult since there were several entities dropping cluster munitions during the air campaign. The separate air components provided mission reports for immediate tracking and future analysis. We received daily reports of all cluster munitions employed in theater. More than 5,000 explosive hazard areas, including cluster munitions and conventional minefields, had been reported by the end of the ground campaign.

Explosive hazards entered in the database exceeded 300 a day during combat operations. The sheer volume of

information was staggering and quickly grew beyond the capability of one data entry person, so our coalition partners provided two soldiers to help. In addition, we received two American terrain analysts who analyzed explosive hazards and their impact on mobility. Without their expertise on the ArcMap® software, we would have been unable to supply many of the requested specialty products to the command. These included distribution of explosive hazards in each Iraqi province and analysis of explosive hazards on main and alternate supply routes. This database would not have been possible without the efforts of those soldiers.

Since the TMFDB was so new and had limited distribution, the CFLCC was forced to enter the data and top-feed information. The CFLCC received information from subordinate commands, entered it into the TMFDB, then sent updated reports to subordinate commands. While this system worked, it was not the preferred approach. All information should have been entered at division level or below and then forwarded to the CFLCC for compilation and dissemination. The CJTF-7 C7 is distributing TMFDB computers down to division level so a bottom-fed reporting system can be implemented, increasing the accuracy and timeliness of reporting.

The TMFDB is only beneficial if units in the field can use the data. TMFDB information, including shape files for topographers to create maps and hazard overlays for the C2PC, is distributed primarily through classified networks. The information is also posted on secure Web sites. In addition, an Excel spreadsheet is posted with all hazard information. One example of a major subordinate command using this information during operations was when the C2PC hazard overlay was used as part of the mission analysis for installing an Inland Petroleum Distribution System (IPDS) (see *Engineer,* July-September 2003, page 13.) A minefield was identified in the proposed location of the pipeline, so the location was changed before construction to reduce the risk posed to soldiers and to avoid a probable delay in construction. A second example of the practical use of TMFDB hazard information was the creation of maps showing hazard areas within 200 meters of all Iraqi pipelines and oil fields. These maps showed oil field repair teams where all the known explosive hazards were located in their area of operations so they could safely identify routes while assessing and repairing oil infrastructure.

As with any database, the output available is only as good as the input received. Engineer units must stress improved recording and reporting of explosive hazards. Accurate and timely data was very difficult to gather and assess during the campaign. An established reporting system would make the TMFDB a bottom-fed process, as desired. For this system to succeed and mature, a peacetime training plan must be implemented at the combat training centers to track dirty battlefields before, during, and after battles. This will exercise the users' understanding of the TMFDB and help report and track explosive hazards present on the battlefield. This effort will reinforce reporting chains and increase situational awareness of explosive hazards on the battlefield.

The TMFDB is a software program that uses a Geographic Information System (GIS) platform. The use of Environmental Systems Research Institute ArcGIS™ software is beneficial since it has been extensively integrated into the military topographic community. Using an existing commercial format and modifying it to meet current needs significantly decreased the fielding time to receive the system and put it into operation. In addition to its powerful computing capabilities, the system is very durable. Hardened computers are loaded with the software (TMFDB, ArcGIS, ArcMap®, ArcToolbox®, ArcCatalog®, FalconView™, MCS-E, Military Analyst, Windows® 2000 Professional, Microsoft® Office) necessary to perform the explosive hazard tracking mission. They also come with an external 200-gigabyte hard drive, loaded with maps and imagery for the entire area of responsibility. Additional hardware includes an uninterruptible power supply and two hard-shell Pelican transport cases.

The prototype TMFDB is the first release in a spiral development of MCS-E. Upon delivery, the database would not merge with other databases, nor would it export to C2PC. Northrop Grumman IT TASC programmers quickly fixed those problems, and the U.S. Army Countermine/Counter Booby Trap Center (CMCBTC) and the Topographic Engineering Center provided upgrades through telephone calls and e-mail messages. These two offices redirected funding and prioritized efforts when needed. Through their hard work, the database became fully functional with additional upgrades that increased the tracking capability of the software.

Although the TMFDB System was in the developmental stages when it was fielded, its capability to process and distribute hazard data proved to be a useful force multiplier. We expect future releases to continue to enhance the capabilities of this system. It was introduced in time to significantly enhance the survivability of our combatants during one of the most violent ground attacks in the history of modern warfare. Fortunately, forward thinkers saw to it that fielding, training, and integration occurred before this campaign commenced. We can attribute better battlespace management to the efforts of the individuals who made this possible.

Captain Birdwell was the CJTF-7 current operations engineer battle captain when this article was written. He is now in the Engineer Captain's Career Course.

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